

APPENDIX B

Columbia Slough

Vegetation Plantings

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R. Ad
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3.3 RIPARIAN VEGETATION

3.3.1 DESCRIPTION

The Watershed Revegetation Program was developed to restore and maintain native vegetation in the upland, riparian, and wetland habitats of watersheds located in the City of Portland. The program accomplishes this task by focusing on several issues: the removal of exotic, invasive plants that are out-competing native plant communities; reducing erosion into streams and sloughs by using bioengineering techniques; and enhancing, restoring and creating wetland habitat to help replace wetland losses due to development and lack of vegetation management.

A. Riparian Revegetation (restoration)

Riparian corridors within the environmental overlay zones extend over the entire length of the Columbia Slough and range from 25 to 50 feet in width depending upon location in the slough. These areas are currently degraded and inoculated with exotic plant species such as Himalayan blackberry and reed canary grass. Partnerships between BES and both public and private landowners enable revegetation projects to be implemented within these E-zones.

Riparian Site Preparation

Site preparation allows access to planting sites and provides open initial growing conditions for planted seedlings. Workers cut exotic vegetation using chainsaws, weed eaters, or industrial mowing equipment, depending on site conditions such as bank configuration and access. Native vegetation is left uncut.

Immediately prior to planting, planters scalp (scrape away grass sod and other vegetation with a planting tool) a two-foot diameter planting spots to reduce vegetative competition and improve planting quality.

B. Wetland Benches (creation)

Areas along levees in the Penninsul-1 and Peninsula-2 drainage districts have been identified for wetland benching projects. The Watershed Revegetation Program works in partnership with the Multnomah County Drainage District and landowners to provide and implement cost-effective solutions to problems arising from degraded waterways.

Wetland benching along the toes of these levees is designed to stabilize the levees and to grow native trees, shrubs, and wetland plants. Benches are classified as 'overbuilds', meaning they are not part of the levee proper and may be planted without threatening the integrity of the levee.

C. Natural Wetland (creation, restoration, and enhancement)

Hydrology is a key factor in determining species composition and richness, primary productivity, organic accumulation and nutrient cycling. The program examines surface and ground water levels, hydroperiods, seasonal pulses, flow patterns, retention times and soil characteristics. Excavation and grading plans are then designed to utilize the natural conditions of the landscape to restore the wetland. Program components include site excavation and grading, vegetation management, and wetland and upland planting.

Natural Wetland and Benching Excavation & Site Preparation

Selected sites are excavated to restore natural wetland hydrology. All excavation and construction are initiated and completed in the dry season (August and September) to minimize erosion concerns. After contouring is completed all soil is subsoiled to a depth of 5 feet to free site of compacted soil. All non-native vegetation is removed during excavation. Creating natural wetland hydrology through contouring and treating soil to remove compaction are key goals of the program because they are fundamental for long term success of any wetland site.

D. General Program Description

Erosion Control

Erosion prevention at newly excavated sites maintains local water quality. Since wetland excavation requires earthwork, erosion prevention techniques are applied immediately after excavation and grading. Erosion is controlled by beginning excavation in late summer or early fall, seeding the area with native grasses (as described in the section on Revegetation Strategy), covering exposed ground with a layer of winter wheat straw at the rate of 2 tons per acre, and installing jute netting with live pole cuttings on steep slopes. Projects where the program has applied these highly effective techniques are available for viewing at 122nd Avenue on Whitaker Slough and at NE Sunderland Avenue.

Plant Material

All plant material installed on restoration project sites is native to the Portland area. The plant inventory is stocked from several nurseries that grow local, native species and Portland Parks Mount Tabor Nursery, which works in conjunction with BES. Seed from native trees and shrubs are collected throughout the year, processed, and propagated at Mount Tabor Nursery and local private nurseries. Collecting and propagating local, native seed preserves local plant genetics, increases survival and growth rates, aims to restore native plant communities, and is cost effective.

Revegetation Strategy

The revegetation strategy effectively uses native plants, live pole cuttings and seeds to establish functional plant communities. Attachment B shows a general planting plan with scaled plant spacing. Enhancement projects are site specific, but the figure represents a "typical" planting layout. The figure illustrates the three basic planting zones at an

enhancement project (emergent wetland, scrub/shrub wetland, and riparian upland). All three zones are seeded with grass/emergent seed mixes at the rate of 12-15 lbs. per acre. Wetland plugs are planted on 30 % to 50% of the wetland emergent zone with a density of 2 plants per square feet. Scrub/shrub wetland zones will have approximately 70% of the zone planted with bare-root shrubs and trees at 4-6 foot spacing and 10% of the zone will be planted with live pole cuttings at two foot spacing. Upland areas will be planted with bare-root trees at a 7-foot spacing. Upland shrubs will be interplanted on approximately 30% of the area (See Table 1 for actual number of plants per acre for each zone). Attachment A lists the native plant species, arranged by habitat, that are used for revegetation.

TABLE 1 - PLANTING AND SEEDING RATES PER ACRE		
Zone	Plants/Acre	Seeding Rate/acre
Emergent Wetlands		12lbs
Wetland Emergent Plugs	40,000-90,000	
Scrub/Shrub Wetlands		15lbs
Trees/Shrubs	1490	
Pole Cuttings	1000	
Upland		15lbs
Trees	890	
Shrubs	600-1000	

Animal Damage Protection

Beaver, nutria, voles, and other rodents can rapidly eliminate tender young trees and shrubs over large areas. To reduce these losses, planters protect seedlings with vexar tubing (photodegradable plastic mesh tubing installed on individual plants) or erosion fencing around large groups of plants, or both. In addition, planting mixtures will include species, which appear to be less prone to damage by rodents; including Oregon ash, conifers, red elderberry, and snowberry.

Mulch

The application of mulch is effective in maintaining soil moisture and suppressing the regrowth of competing non-native vegetation. Mulch is applied in each scalped planting area following plant installation.

Watering

The first two years are critical in the establishment of seedlings. If severe hot and/or dry weather is jeopardizing young plants, sites will be hand irrigated.

Monitoring

BES has prepared monitoring and documentation guidelines for riparian and wetland areas to assess conditions and identify trends to increase continued success of planting

projects. Monitoring includes assessment of plant mortality and its causes. BES will interplant areas where stocking falls below a level that will assure occupancy of the site by native plants within 10 years. BES may prescribe other treatments to reduce further plant mortality or to further enhance project areas.

Other Treatments

Particularly steep and unstable banks, may require excavation to a more stable angle prior to planting or stabilization using bioengineering techniques. Other treatments, such as irrigation, exotic plant removal, and broadcast seeding, may be necessary or desirable on particular sites or under certain weather conditions. BES prescribes these treatments on a site-by-site basis.

Five-Year Maintenance

Non-native vegetation will be suppressed by cutting blackberries, reed canary grass and other exotic vegetation with chainsaws, weed eaters, hand tools or industrial mowing equipment. Workers will cut all resprouting exotic vegetation three times during the first year. In years two, three, and five, workers cut brush once or twice in summer, depending on regrowth. BES monitors planting survival and exotic vegetation re-growth, and prescribes additional treatments as needed.

Long-Term Maintenance and Enhancement

At the end of the five-year establishment phase, BES and Landowner will prepare a long-term management plan that will maintain the project and insure the attainment of project goals. Maintenance after the five-year period will be funded by the Landowner. By this time, native trees and shrubs should be established. Stands of young hardwoods and conifers will become very dense, shading out most exotics. Maintenance in these stands should be minimal after five years. Shade tolerant weeds such as nightshade, English ivy, and holly will require continued monitoring and treatment. Areas planted with native shrubs, forbs, and wetland emergent plants will require extended maintenance.

BES and landowners will manage newly established stands in a variety of ways to achieve resource management objectives. Stands may be thinned to lower densities to allow establishment of understory vegetation and to increase growth of individual plants. Small patches within stands may be cut to provide a weed-reduced environment for the establishment of shrubs and forbs, or dense overstory cover may be maintained to minimize additional maintenance and planting costs.

Public Support

As a result of the program's accomplishments, BES has developed a broad base of public support for watershed revegetation. Jim Pierce of Atlas Copco Wagner, Inc. says "Working on this project with BES has been a very positive experience - bridge-building." In an article in their July 17, 1997 edition, Willamette Week calls the program the "Best Use of Local Tax Dollars. ...BES deserves praise for its Columbia Slough Riparian Restoration Project." When asked if he would recommend the program to other businesses, Dave Franks of Miller Paint responded with an enthusiastic "Yes!" Mike

McKay of Laidlaw Transit, Inc. writes, "...this is a wonderful program at reasonable cost."

The program also has strong support from local natural resource and environmental-regulatory agencies. Following a tour of some of the sites restored by the program, Jerry Hedrick of the Oregon Division of State Lands was highly complimentary of the program in a letter to Commissioner Sten. Metro, Portland Parks, Portland Water Bureau, Multnomah County, Oregon Department of Corrections, and Multnomah County Drainage District No. 1 have all participated in the program to install projects.

Accomplishments

The Watershed Revegetation Program has restored 190 riparian acres within the Columbia Slough Watershed, planting approximately 250,000 native trees and shrubs along 16 river miles of the Columbia Slough. Twenty-five acres of wetland habitat has been created, enhanced and/or restored. In addition, over two acres of eroding banks of the slough have been stabilized and revegetated to prevent further bank failure.

3.3.2 Project Costs

The Watershed Revegetation Program has been able to minimize project cost by implementing cost-effective measures. The program operates on a large, industrial scale resulting in wholesale purchasing power for labor, plants and materials. Program savings are passed on to partners of the Watershed Revegetation Program. Cost estimates for projects are listed as 'adjusted costs' in Attachment C.

3.3.3 Outputs

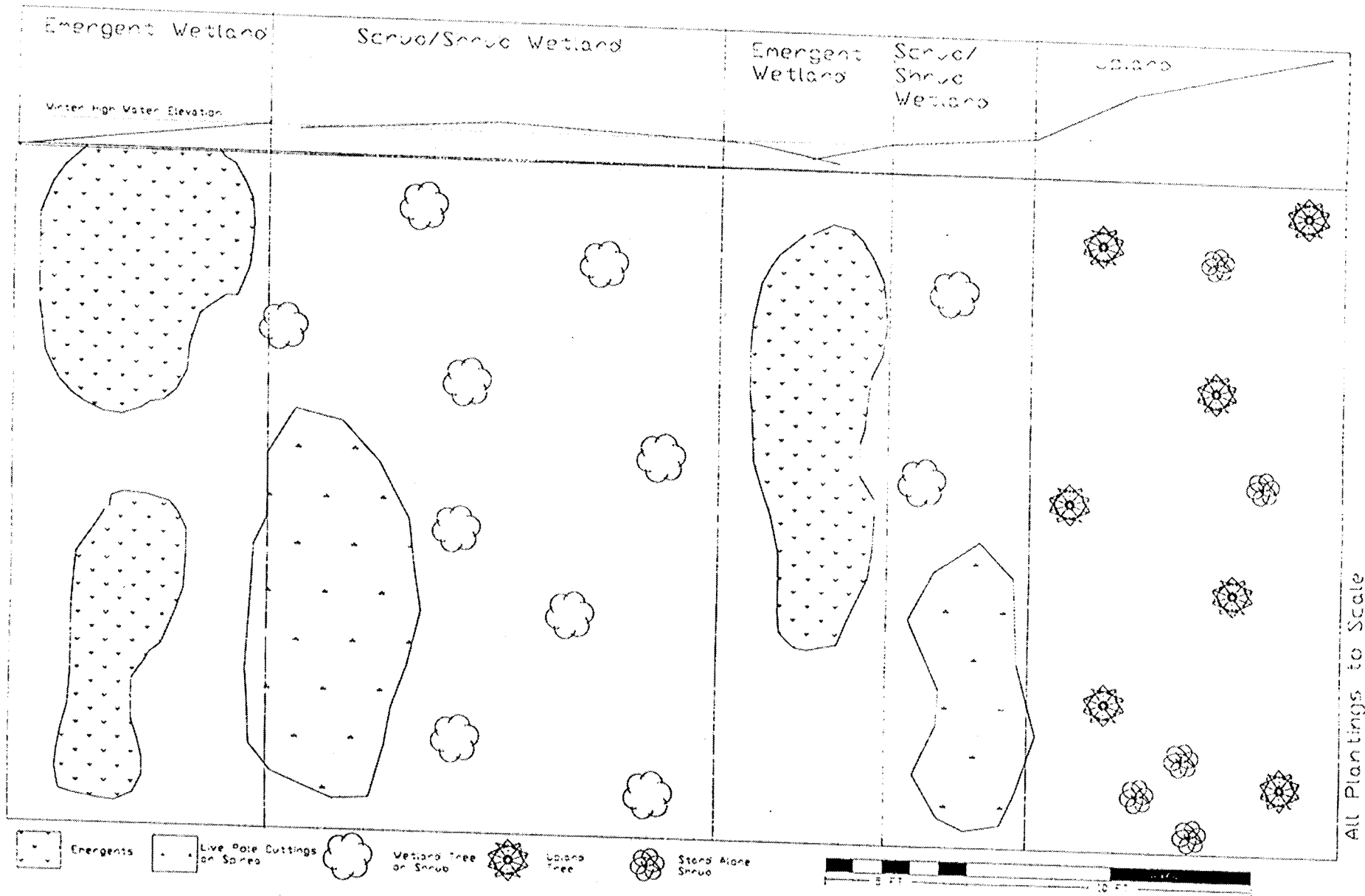
Riparian revegetation, wetland benches, and natural wetlands are intended to collectively improve resource and functional values in the Columbia Slough Watershed. Projects result in an enhanced native plant landscape. This landscape will improve water quality by shading and buffering water surfaces, improving groundwater recharge, increasing flood storage capacity and encouraging biofiltration of sediments. Once established, native vegetation provides habitat and movement corridors for wildlife and increases native plant diversity. In addition, wetland benches will filter and intercept leachate entering the slough and constrict the channel at low flows to increase water velocity and quality.

ATTACHMENT A - ENHANCEMENT PLANT LIST

Upland		Wetland Scrub/Shrubs		Wetland Emergent		Native Grasses	
Upland and Riparian Trees	Spacing (ft)	Wetland Shrubs	Spacing (ft)	Wetland Emergent Plugs	Spacing (ft)	Native Upland Grass Seed*	
<i>Abies grandis</i>	7	<i>Cornus stolonifera</i>	6	<i>Eleocharis palustris</i>	.7	<i>Agrostis exarata</i>	
<i>Acer macrophyllum</i>	7	<i>Fraxinus latifolia</i>	6	<i>Eleocharis ovata</i>	.7	<i>Bromus carinatus</i>	
<i>Alnus rubra</i>	7	<i>Rosa pisocarpa</i>	4	<i>Sagittaria latifolia</i>	.7	<i>Deschampsia cespitosa</i>	
<i>Fraxinus latifolia</i>	7	<i>Salix lasiandra</i>	4	<i>Scirpus microcarpus</i>	.7	<i>Festuca rubra</i> var. <i>rubra</i>	
<i>Populus trichocarpa</i>	7	<i>Salix piperi</i>	4	<i>Scirpus validus</i>	.7	<i>Hordeum brachyantherum</i>	
<i>Prunus emarginata</i>	7	<i>Salix sessilifolia</i>	4	<i>Sparganium emersum</i>	.7		
<i>Pseudotsuga menziesii</i>	7	<i>Salix sitchensis</i>	4	<i>Alisma plantago-aquatica</i>	.7		
<i>Pyrus fusca</i>	7	<i>Spirea douglasii</i>	2	<i>Glyceria occidentalis</i>	.7		
<i>Rhamnus purshiana</i>	7			<i>Carex vulpinoidea</i>	.7	Native Scrub/Shrub Grass Seed	
<i>Salix scouleriana</i>	7	Wetland Pole Cuttings		<i>Carex aperta</i>	.7		
<i>Thuja plicata</i>	7			<i>Carex leporina</i>	.7	<i>Hordeum brachyantherum</i>	
<i>Cornus nuttallii</i>	7	<i>Salix lasiandra</i>	2	<i>Carex obnupta</i>	.7		
		<i>Salix piperi</i>	2	<i>Carex stipata</i>	.7	Native Wetland Grass Seed	
Upland and Riparian Shrubs		<i>Salix sessilifolia</i>	2	<i>Carex unilateralis</i>	.7		
		<i>Salix sitchensis</i>	2	<i>Elymus glaucus</i>	.7	<i>Beckmannia syzigachne</i>	
<i>Amelanchier alnifolia</i>	6			<i>Juncus acuminatus</i>	.7	<i>Deschampsia cespitosa</i>	
<i>Cornus stolonifera</i>	7			<i>Juncus ensifolius</i>	.7	<i>Glyceria occidentalis</i>	
<i>Corylus cornuta</i>	6			<i>Juncus effusus</i>	.7	<i>Leersia oryzoides</i>	
<i>Oemleria cerasiformis</i>	6			<i>Juncus torreyi</i>	.7		
<i>Physocarpus capitatus</i>	6						
<i>Ribes sanguineum</i>	6						
<i>Rosa nutkana</i>	4						
<i>Rubus parviflorus</i>	6						
<i>Sambucus cerulea</i>	7						
<i>Sambucus racemosa</i>	7						
				Native Emergent Seed*			
				<i>Carex leporina</i>			
				<i>Carex obnupta</i>			
				<i>Carex stipata</i>			
				<i>Carex unilateralis</i>			
				<i>Scirpus validus</i>			
				<i>Alisma plantago-aquatica</i>			
				<i>Juncus torreyi</i>			

* Seed mixtures are applied to seeding zones at a rate of 12-15lbs/acres. Various seeding mixtures are used depending on the specific seeding zone conditions.

ATTACHMENT B - "TYPICAL" PLANTING PLAN



Watershed Revegetation Program
WOODY PLANT LIST
1-Mar-00

Trees

Bigleaf maple
Black cottonwood
Douglas-fir
Grand fir
Oregon ash
Oregon white oak
Red alder
Pacific willow
Piper's willow
Ponderosa pine
Rigid willow
Sitka willow
Western hemlock
WRC

Small trees/large shrubs

Black hawthorn
Blue elderberry
Cascara
Mock Orange
Ninebark
Oceanspray
Oregon crabapple
Red elderberry
Red flowering currant
Serviceberry
Vine

Shrubs

Douglas spiraea
Longleaf Oregon grape
Nutka rose
Tall Oregon grape
Red osier dogwood
Salmonberry
Sala
Swamp rose
Swordfern
Snowberry
Thimbleberry
Twinberry

Plant Specs:

all plants grown from local Portland metro area seed sources

All plants are bare root seedlings: 1-0, 2-0, or 1-1 transplants

Minimum height 12"

Maximum height 48"

Plant condition:

healthy plants only; no dead tissues, no broken tops or roots
well-balanced shoot to root ratio. Root length 10-12", fibrous.
Multiple buds, full foliage on evergreens

ID	Species
WRP-107	<i>Achillea millefolium</i>
WRP-108	<i>Achillea millefolium</i>
WRP-94	<i>Agrostis alba</i>
WRP-63	<i>Agrostis exarata</i>
WRP-64	<i>Agrostis exarata</i>
WRP-65	<i>Agrostis exarata</i>
WRP-95	<i>Agrostis exarata</i>
WRP-96	<i>Agrostis exarata</i>
WRP-66	<i>Aleopecurus geniculatus</i>
WRP-109	<i>Alisma plantago-aquatica</i>
WRP-110	<i>Alisma plantago-aquatica</i>
WRP-111	<i>Alisma plantago-aquatica</i>
WRP-112	<i>Alisma plantago-aquatica</i>
WRP-113	<i>Alisma plantago-aquatica</i>
WRP-114	<i>Alisma plantago-aquatica</i>
WRP-115	<i>Alisma plantago-aquatica</i>
WRP-116	<i>Alisma plantago-aquatica</i>
WRP-117	<i>Alisma plantago-aquatica</i>
WRP-118	<i>Alisma plantago-aquatica</i>
WRP-119	<i>Anaphalis margaritacea</i>
WRP-120	<i>Aquilegia formosa</i>
WRP-121	<i>Aster chilensis</i> var. <i>Hallii</i>
WRP-67	<i>Beckmania syzigachne</i>
WRP-68	<i>Beckmannia syzigachne</i>
WRP-69	<i>Beckmannia syzigachne</i>
WRP-97	<i>Beckmannia syzigachne</i>
WRP-98	<i>Beckmannia syzigachne</i>
WRP-99	<i>Beckmannia syzigachne</i>
WRP-70	<i>Bromus carinatus</i>
WRP-71	<i>Bromus sitchensis</i>
WRP-72	<i>Bromus vulgaris</i>
WRP-21	<i>Carex amplifolia</i>
WRP-22	<i>Carex aperta</i>
WRP-23	<i>Carex aperta</i>
WRP-24	<i>Carex aperta</i>
WRP-25	<i>Carex aperta</i>
WRP-26	<i>Carex deweyana</i>
WRP-28	<i>Carex obnupta</i>
WRP-29	<i>Carex stipata</i>
WRP-30	<i>Carex stipata</i>
WRP-31	<i>Carex stipata</i>
WRP-32	<i>Carex tumulicola</i>
WRP-33	<i>Carex unilateralis</i>
WRP-34	<i>Carex unilateralis</i>
WRP-35	<i>Carex unilateralis</i>
WRP-36	<i>Carex vesicaria</i>
WRP-37	<i>Carex vulpinoidea</i>
WRP-38	<i>Carex vulpinoidea</i>
WRP-39	<i>Carex vulpinoidea</i>
WRP-40	<i>Carex vulpinoidea</i>
WRP-73	<i>Danthonia californica</i>

WRP-74 *Deschampsia caespitosa*
WRP-75 *Deschampsia caespitosa*
WRP-76 *Deschampsia caespitosa*
WRP-77 *Deschampsia caespitosa*
WRP-100 *Deschampsia cespitosa*
WRP-78 *Deschampsia elongata*
WRP-41 *Eleocharis ovata*
WRP-42 *Eleocharis ovata*
WRP-43 *Eleocharis palustris*
WRP-44 *Eleocharis pulustris*
WRP-101 *Elymus /Bromus Mix*
WRP-79 *Elymus glaucus*
WRP-80 *Elymus glaucus*
WRP-81 *Elymus glaucus*
WRP-82 *Festuca occidentalis*
WRP-102 *Festuca occidentalis*
WRP-83 *Festuca romeri*
WRP-84 *Festuca rubra*
WRP-85 *Festuca rubra*
WRP-86 *Festuca rubra*
WRP-87 *Festuca rubra v. rubra*
WRP-88 *Festuca rubra/Elymusmix*
WRP-89 *Glyceria occidentalis*
WRP-90 *Glyceria occidentalis*
WRP-103 *Glyceria occidentalis*
WRP-104 *Glyceria occidentalis*
WRP-91 *Hordeum brachyantherum*
WRP-92 *Hordeum brachyantherum*
WRP-105 *Hordeum brachyantherum*
WRP-45 *Juncus acuminatus*
WRP-46 *Juncus acuminatus*
WRP-47 *Juncus ensifolius*
WRP-48 *Juncus oxymers*
WRP-49 *Juncus tenuis*
WRP-50 *Juncus Torreyi*
WRP-51 *Juncus Torreyi*
WRP-52 *Juncus Torreyi*
WRP-93 *Leersia oryzoides*
WRP-106 *Poa compressa*
WRP-53 *Scirpus microcarpus*
WRP-54 *Scirpus microcarpus*
WRP-55 *Scirpus microcarpus*
WRP-56 *Scirpus microcarpus*
WRP-57 *Scirpus validus*
WRP-58 *Scirpus validus*
WRP-59 *Scirpus validus*
WRP-60 *Scirpus validus*
WRP-61 *Scirpus validus*
WRP-62 *Scirpus validus*